Math 355
College Geometry
CSULB
Fall 2014

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Overview

Geometry is an immensely rich subject. As more than just one of the *branches* of math, geometry motivates and connects various mathematical subjects. One often finds geometric themes and connections in apparently non-geometric areas. Conversely, considerations from algebra and calculus, for instance, can enhance an understanding of geometric matters.

In this course we'll develop mathematical understanding by exploring of specific questions. There are several aspects to the course.

Exploration: to develop experimental and perceptual approaches to problems;

Understanding: to acquire insight into basic questions—their statement, elaboration, and elegant solution;

Zen: to develop mathematical *points of view* for approaching problems.

This semester, the course is running as part of the **Long Beach Project in Geometry and Symmetry**—an ongoing effort to promote thinking that's rooted in perception and experimentation. The project's centerpiece is *The Geometry Studio* which we'll be using as a classroom.

Your critical comments—signed or anonymous—on the project or studio experience are welcome at all times. Toward the end of the semester, we'll invite you to evaluate your experience in the course.

Getting involved

A typical class session will consist of working on activities provided in class-discussions or handouts. You'll work in groups of 2-4. From time to time we'll discuss matters as an entire class. The key to success in this course is **initiative**—a willingness to try things and contribute.

Much of our work will be *open-ended* in the sense that you won't solve a problem *completely*. Chances are that I won't have all the answers either. Math really works this way—you're able to figure some things out, but there's still more to understand. This is like hiking in the mountains—you reach one peak and gain a nice view, but there are more peaks around you.

Open studio At scheduled times—to be announced—outside of class the studio and its resources will be available to you. I encourage you make regular visits in order to work with classmates exploring questions, developing a project, to chat with Scott, or just to hang out and play.

Getting stuck

One of the inevitable results of this process is your being in a position of not knowing what to do next (often, what to do first). Such moments have great importance—you now have an *opportunity* to advance your understanding. Unfortunately (or fortunately?), there's no formula for how to proceed. You want to find a **way of looking** at the situation that will allow you figure out something. Sometimes considering a simple example helps or doing some experiments or calculations. This

takes effort and practice. The class will provide you with the chance to practice, the effort part is up to you.

> Stuckness shouldn't be avoided. It's the physic predecessor of all real understanding. An egoless acceptance of stuckness is a key to an understanding of all Quality, in mechanical as in other endeavors. It's this understanding of Quality as revealed by stuckness which so often makes self-taught mechanics so superior to institute-trained men who have learned how to handle everything except a new situation.
>
> —*Zen and the Art of Motorcycle Maintenance*

Getting together

One of the things that you *can* do when you're stuck is to work with classmates. Having access to another point of view can enhance your own. Maybe no one in a group knows what's going on completely. But, you might be able to draw from the know-how of each member in piecing together something that moves you forward. The classes are designed for this kind of work. I hope that you'll extend your collaborations outside of class-time. An additional resource is to chat with me during office hours or at an arranged time.

Getting it

Once you've found a way of making sense of something, it's valuable to communicate it. Indeed, this further refines your understanding. You'll do this both orally and in written form. Remember, I don't expect you to get everything—some of the topics we'll consider can be pursued at great length. I'm looking for *insight* and *independent* thought as well as a willingness to try things out. Do you see connections between various concepts and theories? Between math and the physical/cultural world? Take pleasure in the understanding that you do achieve and keep trying.

Explorations

Near weeks 5, 10, and 15 there will be assignments due consisting of exercises that will further class explorations. You will receive a written description of an assignment at least two weeks before it's due—**12 noon Friday** of the specified week. This work will form the core of the course. Since much of this material will come from work in class, frequent absence might produce a serious handicap.

I urge you to **work with others** and to consider the problems at some length before asking about them in class. I also encourage you to ask about the problems. You may submit a write-up for the exercises as a group of two (recommended) or three. The work represented in what you submit should be **your own.** Everything that you submit should be written in concise, clear sentences. Experiment with various styles in developing one that works. For help with writing, take a look at the following site.

`edisk.fandm.edu/annalisa.crannell/writing_in_math/guide.html`

For each assignment you may resubmit one read item for up to 90% credit. (Submit the original with the rewrite.) Late work will be marked for up to 80% credit. The **deadline** for re-submissions and late work is the **final day of classes**—before final exams week.

Since I'll read for content only a select number of the items submitted, the mark for each assignment will consist of two pieces.

Effort	1/3	How much of the work appears to be the result of honest effort.
Content	2/3	Selected work that will be read carefully and commented upon.

Problem presentation

> Pooh began to feel a little more comfortable because when ... you Think of Things, you find sometimes that a Thing which seemed Thingish inside you is quite different when it gets out into the open and has other people looking at it.
>
> –*The House at Pooh Corner*

Each student will present to the class a solution of a selected exercise from the assigned exploration. This should be structured to take no more than 10 minutes. Your mark will reflect your understanding of and insight into the math and your effectiveness in their communication. You're encouraged to make presentations in a group of two (preferred) or three.

Course project

Find a topic to be examined independently. A list of ideas will appear after a few weeks. If you come up with your own topic, so much the better. But, bear in mind that your project should have a *narrow focus* and *substantive mathematical content*.

I encourage you to work in groups (2-3 members). Be advised that the standards for group work will be proportionally higher. You will also provide a project write-up—length is not important. (Typically, 3-5 pages should suffice.) Clarity, creativity, and illumination are what matter most.

You'll present your findings to the class (10-15 minutes) during the final exam session. (If there's not enough time then, we'll use the last week of class.) If you work in a group, each member must make some contribution during the presentation.

I recommend that, by 11th week, you discuss a proposal with me. A number of useful items will be referenced on the website. If you're having trouble, please see me.

WWW

Materials related to the course (course description, assignments, reference materials) will appear at project's website,

`geomsymm.cnsm.csulb.edu`

Feel free to make recommendations for things that you'd like to see on the site.

Coarse outline

Week	**Topic**
1-4	Symmetry and polyhedra
5-9	Patterns in one and two dimensions
10-12	Surfaces and knots
13-15	Shortest paths, optimal shapes
16 (12:30-2:30 Thursday 11 Dec)	Project presentations

Getting evaluated

Exercises	50%
Problem presentation	20%
Course project and presentation	30%

Here's a *rough* indication of how I will assign grades. These are **minimum** standards. The actual boundaries between grades might be lower than these, but won't be higher.

85-100%	A
75-85%	B
65-75%	C
50-65%	D

To each individual part of your work I assign a mark 0-10. See below for an *indication* of what these marks mean.

10	Clear, elegant, mathematically correct, shows depth of understanding, insight
9.....	Clear, shows understanding and some elegance and insight, mathematically correct
8.....	Mathematically correct, little elegance and insight
7.....	Mostly mathematically correct, little elegance and insight
6.....	Some significant misconceptions
5.....	Quite significant misconceptions
0-4....	Deep misconceptions—shows little effort.

Let me know if you're happy or unhappy about something.

Key to comments on marked papers

a	This needs a supporting **argument**.
a?	What's the **argument**—the line of reasoning—here?
d	**Describe** what's going on here.
e	**Explain** what you're doing here.
h?	**How** did you get this?
i	**Illustrate** what your talking about—give an example, a picture, etc.
p	A **picture** would help here.
s	This is not a **sentence**.
w	**Wording** is awkward, confusing, etc. Meaning is unclear.
y?	**Why** is this so? What's the connection to what you've already said?
!	Very nice. Something especially clear, insightful
?	What this means or what you're doing is **unclear**. Where does this come from?
X	Something's wrong here—in concept or calculation.
$\surd$	This is right—you have the idea.

Fine Print

This course will be conducted within the guidelines of the following mathematical practices:

1) Make sense of problems and persevere in solving them.
2) Reason abstractly and quantitatively.
3) Construct viable arguments and critique the reasoning of others.
4) Model with mathematics.
5) Use appropriate tools strategically.
6) Attend to precision.
7) Look for and make use of structure.
8) Look for and express regularity in repeated reasoning.

Withdrawal A copy of the School of Natural Sciences withdrawal policy is available from the Department Office. Note that it's different from the University withdrawal policy and the deadlines are earlier. Deadlines to which you should pay particular attention to appear below. Withdrawals from this course will be allowed only in accordance with University and College policies. Please be aware of the more specific and restrictive withdrawal policy for the College of Natural Sciences and Mathematics.

Note: The department chair will personally interview every student who intends to withdraw from a math class after the second week of instruction this semester.

Weeks 1-2. Withdrawals will not appear on the student's permanent record.

Weeks 3-8. Withdrawals are permissible only for serious and compelling reasons. Academic progress unsatisfactory to the student is considered a serious and compelling reason during this period. Instructor and Department Chair signatures on the drop form are required.

Weeks 9-12. Withdrawals are permissible for serious and compelling reasons, but during this period, unsatisfactory academic progress is not considered a serious and compelling basis to drop a course. Circumstances must be shown that preclude the student from attending class or from any effective opportunities to study. In addition to the normal withdrawal form, a special form must be completed, and instructor and department chair signatures are required.

Weeks 13-15. Withdrawals are permissible only for serious accident or illness and involve a total withdrawal from the University. Detailed written documentation must accompany withdrawal forms. Instructor, chair, and college dean signatures are required.

Disability It is the student's responsibility to notify the instructor in advance of their need for accommodation of a disability that has been verified by the University.

Cheating/Plagiarism Cheating and plagiarism are in violation of the California Administrative Code, Title 5, Section 41301. CSULB has adopted a specific policy with respect to the violations of this nature (see the Bulletin or Schedule of Classes). Any student in violation of this code and policy in any assignment or examination related to this course shall be subject to the options specified in the policy statement. This may result in the student receiving a failing grade in the course or, in certain circumstances, being expelled from the University.